Crystal Set with Q Multiplier

I found a very interesting YouTube video, showing an application of a Q multiplier to a crystal radio.

The base set is the one published by Mr. (http://www.geojohn.org/Radios/MyRadios/CRKit/CrystalKit.html)John Fuhring (http://www.geojohn.org/Radios/MyRadios/CRKit/CrystalKit.html). It uses two toroidal cores for antenna tuning and station tuning. Linking the two toroids are done by few turns of coupling coils on both of the cores. I used the same cores (T80-15 (http://www.amidoncorp.com/t80-15/)) as in the original article. The linking coils are wound by 24 AWG wire, connected to a 100 ohm variable resistor which attenuate the signal to the secondary coil.

I used 40/60 litz wires for the tuning coils, which was suggested in the Fuhring's article. Another difference between the original and mine is to have an additional tap for the Q multiplier.

The Q multiplier I used was shown in the video by Mr. VK3YE in YouTube (https://www.youtube.com/watch?v=4ix5gNrJy2E). Capacitance between the hot end of the tank circuit and the base of transistor is critical. If it is too large, say 100 pF, it rings all the time. If it is too small, it does not work. At first, I twisted the wire from Q1 to the one from C2, as suggested in the video, the connection was too weak. So, I twisted the two wires as shown in the photo. My guess of the capacitance is about 15 pF.

Performance of the base set is not bad, but not great. There must be many possible reasons that mine may not be as good as the original, although I cannot think of any. The sensitivity is a little less than the Loose Coupler set (LC). The selectivity is as good as the LS, but this set requires no special tuning procedure, which is needed in tuning with the LC. I could listen three local stations very well, but no other stations could be heard even at night with an audio amplifier connected to the output.

With the Q multiplier ON, the sensitivity increased dramatically. Several stations in Tokyo (200 km away) could be heard after tuning with patience. The variable capacitor, especially the secondary for station tuning, needs to be adjusted very little by little, and it also changes its capacitance with my hand. If I assemble the set again, I would 1) use air variable capacitors, instead of poly film ones, 2) add vernier drive mechanism to the secondary variable capacitor, and/or 3) add a variable capacitor with a small capacitance, e. g. 10-20 pF, parallel to C2 for final adjustment.

Fortunately, I have an old SONY ICF-7600D (http://stephan.win31.de/sony76-4.htm) BCL radio, so I used it for making its tuning very easy for specific stations. First, set the receiving frequency of ICF-7600D to the frequency of the station you want to listen and leave it on. Then rotate the tuning dial of the set and find the point which causes the oscillation noise on the 7600D. This means that the set is tuned at the same frequency as the 7600D is receiving, which is digitally displayed on it. Remaining work is not so difficult if the signal is strong enough. Final tuning should make the station audible. I have received 5 stations with 50-100 kW power within the 300 km range in addition to the local ones. FYI: Transmitting power of radio stations in Japan is not as strong as other countries, in general.

Selectivity of the set becomes very sharp with Q multiplier, but since there are no overwhelming stations in my area, I have no trouble separating stations without it.

Playing with this machine is fun, but without Q multiplier, there is not much left to do. With the Q multiplier, it is exciting to listen distant stations, but I feel guilty for using it, because, although it is not directly amplifying the signal like regenerative radio, it is still with a help from a battery.

August 15, 2016

On the night of September 29, 2016, the following stations were caught when Q multiplier was ON. All stations were

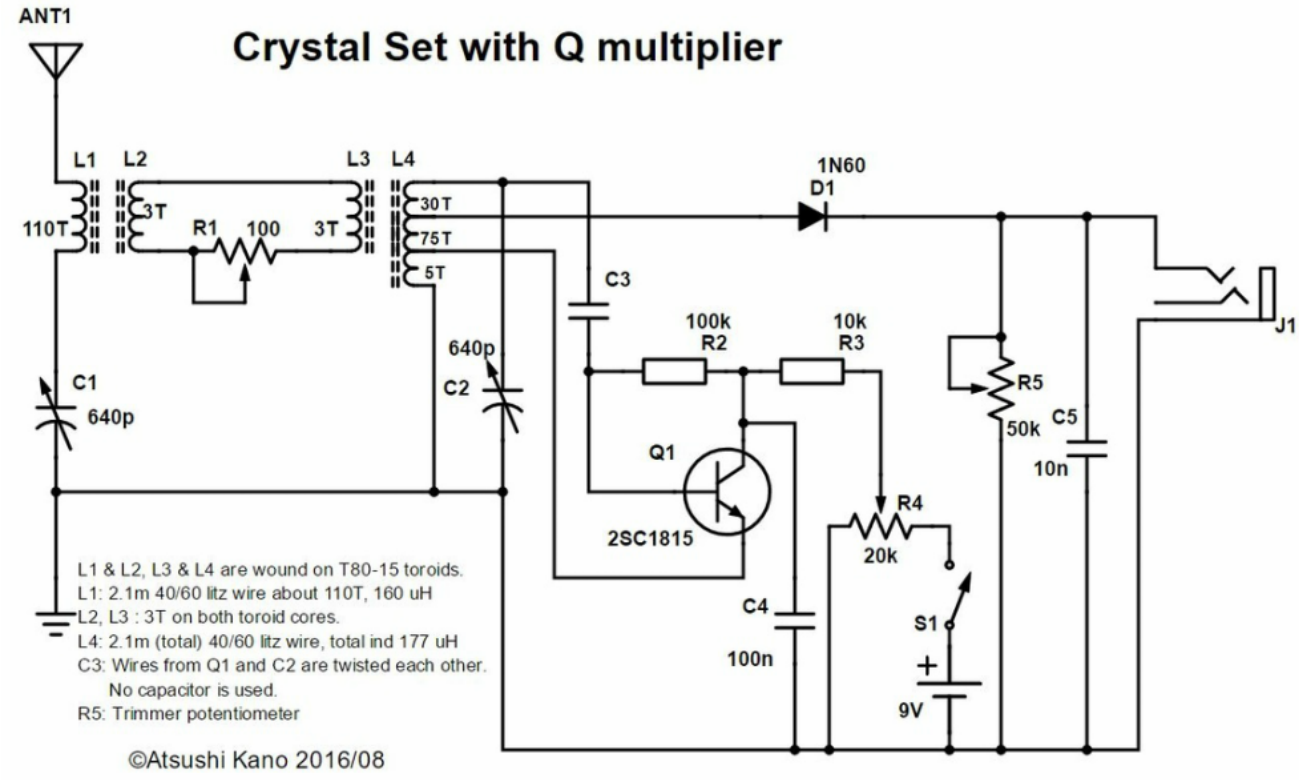
listened through an audio amplifier.

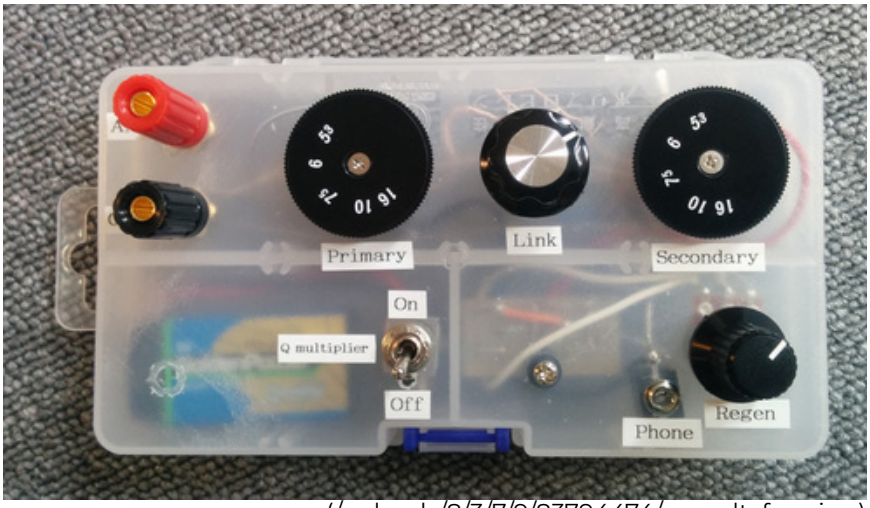
Frequency, kHz	Call sign	Location
639	JOPB	Shizuoka
711	HLKA	Incheon, Korea
747	JOIB	Sapporo
774	JOUB	Akita w/QRM
810	AFN	Wako w/QRM
828	JOBB	Osaka
846	JOCP	Koriyama
882	JOPK	Shizuoka
954	JOKR	Tokyo
972	HLCA	Danging, Korea
1008	JONR	Osaka
1089	JOHB	Sendai
1134	JOQR	Tokyo
1170	HLSR	Gimje, Korea
1242	JOLF	Tokyo
1314	JOUF	Osaka
1404	JOVR	Shizuoka
1566	KLAZ	Jeju, Korea

All stations are in Japan except those in Korea.

It seems sensitivity of the set is not good when frequency is below 700 kHz. No stations near 1400 kHz were heard because of the strong signal at 1404 kHz.

October 2, 2016



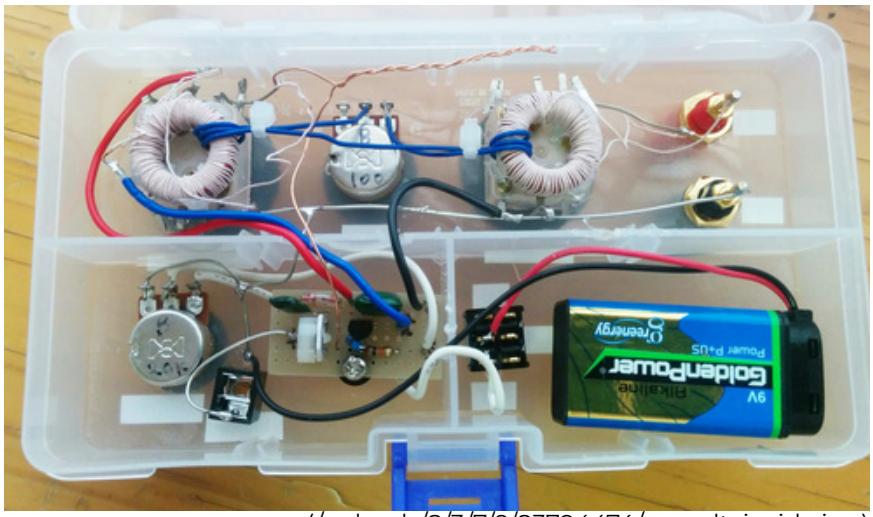


(/uploads/8/3/7/9/83794474/q_mult_face.jpg)

Face of the set

I used a small plastic tackle box sold at 100 yen (about US$1.00).

Top half is the crystal set designed by Mr. John Fuhring and right bottom is the Q multiplier . As I mentioned in the above, it is not easy to tune faint stations because my hand effects on the tuning while it is on the dial.

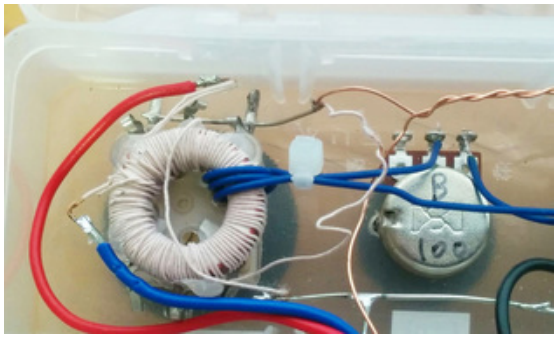


(/uploads/8/3/7/9/83794474/q_mult_inside.jpg)

Inside

I put all the parts for Q multiplier, the detecting diode, and few other parts for the crystal set on a small universal electronic board. The trimmer potentiometer, R5, was set to about 40 k after a few adjustments. Coils are hot-glued to the back of variable capacitors.

You can see the twisted wires, C3, for coupling signal from L4 to the base of Q1. The thinner blue wire forms L2 and L3. Originally it was a litz wire, but the link was too strong, so I changed it to the ordinary AWG 22 wire.



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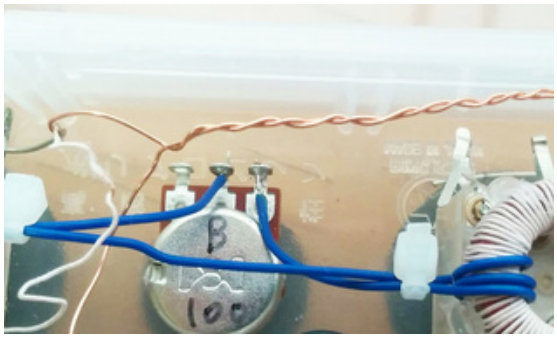

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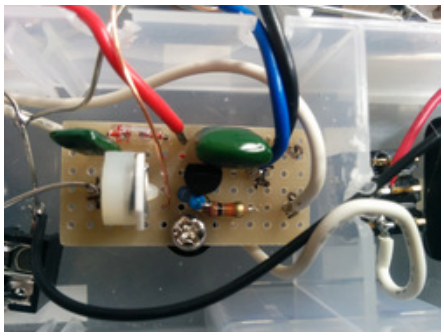

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